

REMARKS

Reconsideration is respectfully requested. Claims 1-23 were present in the application. Claims 8-23 are withdrawn, as directed to non-elected invention. Claim 1 is amended herein. Claims 6 and 7 are canceled. New claim 24 is added.

Support for new claim 24 was present in the application as filed, in other claims already present and in the specification, for example at page 8, lines 2-9. Support for the amendments to claim 1 was present in the application as filed, in other claims already present and in the specification, for example at page 8, lines 20-22.

Claims 1-7 are rejected under 35 U.S.C. §103(a) as allegedly being unpatentable over Sugahara (JP 09-007591) in view of Hayashida (US 2001/0041292) and Katou (JP 2003-309327) and Okada (JP 2002-256301). Applicants respectfully traverse.

I. Features of the Present Claims as Amended

(1) The present claim 1 is amended to read as follows.

1. (currently amended) A sealed type nickel-metal hydride battery, comprising a positive electrode comprising an active material composed mainly of nickel hydroxide, a negative electrode comprising a hydrogen storing alloy particle composed mainly of a rare earth element, nickel and a transition metal element that absorb and desorb hydrogen, and an electrolyte

composed mainly of an aqueous solution of an alkaline metal hydroxide, wherein:

a layer that contains more nickel than a matrix component does and has the thickness of 50 nm and more to 400 nm is located on a surface of said hydrogen storing alloy particle, layers that contain more nickel than a matrix component does are located on a surface of cracks that open at the surface of said hydrogen storing alloy particle, said layers are formed by treatment of said hydrogen storing alloy particle with said cracks with an alkaline aqueous solution,

and, said hydrogen storing alloy particle further contains one or two or more metals selected from the group consisting of erbium, yttrium, and ytterbium.

(2) The present claims as amended (to be referred to as "the present claims" hereinafter) have the following features.

It is described in the specification of the present application that "When conventional preparation processes are applied to alloys having yttrium, ytterbium, and erbium added into their compositions, it is impossible to obtain batteries having improved high-rate discharge capability because of slow activation. With application of the inventive preparation process, however, more than 80% of the discharge capacity at the fourth discharge in the step wherein operation involving a 12-hour charge at 0.1 ItA and a discharge down to 1V at 0.2 ItA was

repeated four times could be achieved in the aforesaid formation step with a 10 ItA high-rate discharge at 5°C. The corrosion resistance of the alloy is represented by the necessary treating time, indicating that, in Examples 11, 12 and 13, cycle life is much more improved by improvements in the corrosion resistance of the alloy. Especially in Example 11 with the addition of yttrium, cycle life performance of as high as 1,030 cycles was obtained." (specification of the present application, page 48, lines 1 to 17).

In other words, the present claims are characterized in that "a hydrogen storing alloy that further contains one or two or more metals selected from the group consisting of erbium, yttrium, and ytterbium" are used to form "layers that contain more nickel than a matrix component does are located on a surface of cracks that open at the surface of said hydrogen storing alloy particle" as defined in Claim 1 by way of "treatment of said hydrogen storing alloy particle with said cracks with an alkaline aqueous solution", which is the inventive preparation process. Then, as a result, an effect of obtaining a high-rate discharge capability and remarkably improving the cycle life can be achieved.

II. Comparison and Examination between the present claims, Sugahara (JP 09-007591), Hayashida (US 2001/0041292), Katou (JP 2002-309327) and Okada (JP 2002-256301)

On the other hand, Sugahara describes an invention of "a hydrogen storing alloy formed by generating a layer containing Ni as principal ingredient but not having any rare earth hydroxide on the surface of a rare earth hydrogen storing alloy having a CaCu_5 type crystal structure the thickness of the layer containing Ni as principal ingredient being 50 nm to 200 nm"

(Claim 1). It also describes that "a rare earth hydrogen storing alloy having a CaCu_5 type crystal structure that is used for the purpose of the present invention is an alloy formed by using a rare earth metal referred to as so-called mischmetal (Mm) or lanthanum-rich mischmetal (Lm) and metals selected from Co, Mn, Al and so on. Mm is a metal obtained by substituting part of the La of an LaNi_5 based alloy having a CaCu_5 type crystal structure with Ce, Pr, Nd and some other rare earth element(s). It is a mischmetal containing, for example, Ce by 45 wt%, La by 30 wt% , Nd by 5 wt% and other rare earth element(s) by 20 wt%. Lm is a mischmetal containing lanthanum by not less than 40 wt%."

([0014]) and it is also describes that "examples of rare earth hydrogen storing alloys include inter-metallic compounds in which the La of LaNi_5 based alloy is partly substituted by Ce, Pr, Nd and some other rare earth element(s) and/or said Ni is partly substituted by metals such as Co, Mn, Al and so on, although the Ni is at least partly substituted preferably by Mn, more preferably by Al, most preferably by Co from the viewpoint of achieving an excellent cycle life. Specific examples of such

inter-metallic compounds include an alloy in which 20 wt% of La is substituted by Ce and 15 atomic%, 7 atomic % and 6 atomic% of Ni are substituted respectively by Co, Mn and Al." ([0015]), although Sugihara does not describe any use of "a hydrogen storing alloy that further contains one or two or more metals selected from the group consisting of erbium, yttrium, and ytterbium".

Katou describes "A hydrogen storing alloy for electrodes, characterized in that cracks are formed on the surfaces of the hydrogen storing alloy particles and a nickel-containing coat layer is formed on the surfaces of the hydrogen storing alloy particles and in the inside of the cracks." (Claim 1) and "while there are no limitations to the kind of hydrogen storing alloy particles to be used according to the present invention, a more satisfactory effect can be achieved when hydrogen storing alloy particles with less amount of nickel in the hydrogen storing alloy component and containing vanadium that has a high hydrogen storing capacity, more particularly hydrogen storing alloy particles of a body-centered cubic structure such as Ti-V-Ni based alloy particles or Ti-V-Cr based alloy particles, are used." ([0012]) but does not describe any use of "a hydrogen storing alloy that further contains one or two or more metals selected from the group consisting of erbium, yttrium, and ytterbium".

Okada describes that "the present invention relates to a method of manufacturing alloy powder for electrodes comprising a first step of immersing material powder consisting of a hydrogen storing alloy containing Ni by 20 to 70 wt% into an aqueous solution containing sodium hydroxide by 30 to 80 wt% at not lower than 90°C and a second step of washing the powder subjected to the first step with water. The present invention also relates to the method of manufacturing alloy powder for electrodes that further comprises a third step of mixing the water-washed powder with an oxidizing agent in water after the second step."

([0009]), that "said material powder preferably comprises an alloy having a CaCu_5 type crystal structure and containing a mixture of rare earth elements as well as Ni, Co, Mn and Al. Then, the Co content of said material power is preferably not more than 6 wt%. The average particle size of said material powder is preferably 5 to 30 μm . Said material powder normally has oxygen on the surface and the oxygen content thereof is preferably not more than 1 wt%." ([0010]) and that "for the composition of the hydrogen storing alloy, it preferably contains a mixture of rare earth elements (Mm: mischmetal) as well as Ni, Co, Mn and Al as indispensable component elements. Further, the crystal structure of the hydrogen storing alloy is preferably of CaCu_5 type." ([0024]) but does not describe "a hydrogen storing alloy that further contains one or two or more metals selected from the group consisting of erbium, yttrium, and ytterbium".

On the other hand, Hayashida describes a hydrogen storing alloy containing yttrium but as described above, it is impossible to obtain batteries having improved high-rate discharge capability, because conventional preparation processes are applied to alloys having yttrium added into their compositions.

Additionally, Hayashida suggests neither processing an hydrogen storing alloy containing yttrium such that "layers that contain more nickel than a matrix component does are located on a surface of cracks that open at the surface of said hydrogen storing alloy particle" nor "treatment of said hydrogen storing alloy particle with said cracks with an alkaline aqueous solution".

Therefore, it is not obvious to those skilled in the art to use "a hydrogen storing alloy that further contains one or two or more metals selected from the group consisting of erbium, yttrium, and ytterbium" for a hydrogen storing alloy particle having "layers that contain more nickel than a matrix component does are located on a surface of cracks that open at the surface of said hydrogen storing alloy particle".

As has been described above, the present claims are not obvious from the teachings or suggestions of Sugahara, Hayashida, Katou and Okada, whether considered alone or combined.

In light of the above noted amendments and remarks, this application is believed in condition for allowance and notice thereof is respectfully solicited. The Examiner is asked to

contact applicant's attorney at 503-224-0115 if there are any questions.

It is believed that no further fees are due with this filing or that the required fees are being submitted herewith. However, if additional fees are required to keep the application pending, please charge deposit account 503036. If fee refund is owed, please refund to deposit account 503036.

Respectfully submitted,


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